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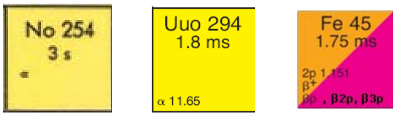
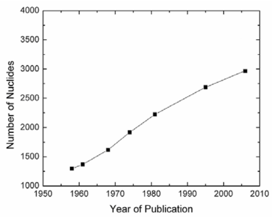
The „Karlsruher Nuklidkarte”
50 years of scientific achievements

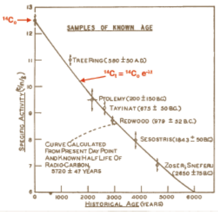


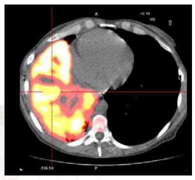
If in 1958, the heaviest element was Nobelium (102), the current edition hosts Ununoctium (118). If the number of nuclides has been multiply by three, new modes of decay (i.e. 2 proton emission) have also been discovered giving some more information about our knowledge on nuclear structure.

Until around 1970, the way sub-atomic particles interact by exchanging weak and strong forces, was ill-understood. Only the electro-magnetic interactions could be handled accurately, by applying a systematic scheme of successive perturbations.
This situation improved dramatically when what is now known as the Standard Model was discovered. The weak forces could henceforth be handled as accurately as the electromagnetic ones, and also the strong force is now understood, even if high accuracies are still a challenge for computational approaches. Accuracy and precision are the primary aims in Physics, and the Standard Model proudly features both.
But our insights need to be checked and improved continuously. Interactions involving neutrino emission form an important battleground. Neutrinos show that quarks of different flavours are mixed, as well as the neutrinos themselves, and the processes involved should obey unitarity rules. Are these rules obeyed? How accurately? Can we say something more about neutrino masses? Is lepton number absolutely conserved? Nuclear physics precision measurements are essential for addressing such questions. This adds an element of very fundamental science to the long list of useful reasons for a systematic study of nuclear reaction processes.
Gerard 't Hooft
Institute for Theoretical Physics, University of Utrecht (The Netherlands)



The Karlsruhe Nuclide Chart is a unique tool for the nuclear science community that presents structured and accurate information on the radioactive decay of nuclides. Through the successive editions dating back to 1958, the chart has evolved to reflect scientific progress and breakthroughs. The discovery of new modes of decay or the study of nuclides far from the stability region is reflected in the various chart editions. The latest 7th edition (2006) contains information on scientific progress over the last 50 years.





Nuclear data and nuclear techniques have found widespread applications. Carbon dating or medical imaging are some examples of the impact of nuclear science research in our everyday life.

The areas of applications include health care, forensic sciences, archaeology, agriculture, industry, material science, geology, hydrology, life sciences, pollution control and astronomy, in addition to basic sciences. In these applications either an isotope is used as a tracer or scattering and attenuation of radiation is exploited or radiation is used in the processing of materials. […]The Karlsruhe Nuclide Chart is frequently used as a ready reference material. This chart is also an invaluable teaching aid to explain the nuclear properties to students. I am happy to share that the Indian Association of Nuclear Chemists and Allied Scientists (IANCAS), a professional scientific body in Bhabha Atomic Research Centre (BARC) with a mission to popularizing nuclear science in academic institutes in India, has been using this wonderful chart in teaching nuclear chemistry to the high school students in workshops with great degree of success. Besides this, the nuclide chart is a familiar feature in many a research nuclear science laboratory in BARC.
Continuous investigative scientific endeavour has led to innumerable applications of radioisotopes and radiations aimed at improving quality of our lives.
Srikumar Banerjee
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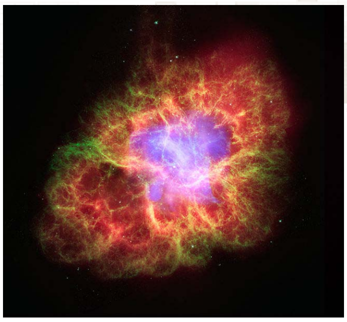
G. Pfennig and W. Seelmann-Eggebert the first two authors of the Karlsruher Nuklidkarte with G.T. Seaborg, Nobel Prize winner 1951



All the elements naturally occurring were produced in cosmological sites as supernovae. The stardust we are made from, and the universe in general, are still not well known. Neutrinos, Dark Matter, Antimatter are waiting hints to solve these secrets.

A few years later, while studying radioactive substances, several scientists, including Ernest Rutherford and Frederick Soddy, discovered that some of them could have different physical properties and be unseparable by chemical techniques. In 1913, Soddy named these substances "isotopes", which meant that they should be placed in the same box of the Mendeleev table. It was rapidly understood that such species exhibited a similar electronic environment, but had different atomic nuclei. The exact explanation came only in 1932, when James Chadwick discovered the neutron: two isotopes of the same element have the same number of protons but different neutron numbers. This discovery gave way to the classification of nuclei according to their numbers of protons (Z) and neutrons (N). All isotopes could then be represented in a bi-dimensional table, each box corresponding to a given (Z, N) value. The chart of nuclides was born.
But this chart was almost empty! Beyond the stable isotopes, the chart contained only a few members of the radioactive families of thorium and uranium. […] Since that time, isotopes have been more and more used for scientific, industrial and medical applications, and the nuclide chart has become an indispensable tool for the scientists and engineers involved in all these domains.
René Bimbot
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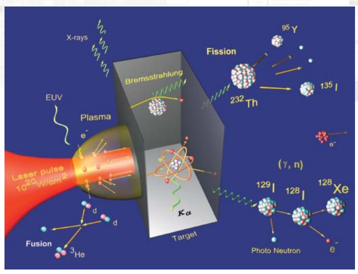

New technical developments have made possible the dramatic increase of our nuclear knowledge. The alpha radioactive sources from the Joliot-Curie, the neutrons from Fermi, or today the EURISOL accelerator and the laser induced reactions, have been necessary tools to the exploration of the Nuclide chart.

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